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(71) Applicants: CENTRE DE RECHERCHE INDUSTRIELLE DU QUEBEC [CA/CA]; Parc Technologique du Québec Métropolitain, 333 Franquet Street, Ste. Foy, Québec G1P 4C7 (CA). BIOMA RECHERCHES INC. [CA/CA]; 1282 Sherbrooke St. East, Montréal, Quebec H2L 1M1 (CA).

(72) Inventor: TERREAULT, Gérard; 4655 Snyder, Pierrfonds, Quebec H9J 3P5 (CA).

(74) Agents: FORTIN, Jean-Pierre et al.; Swabey Ogilvy Renault, Suite 1600, 1981 McGill College Avenue, Montreal, Quebec H3A 2Y3 (CA).

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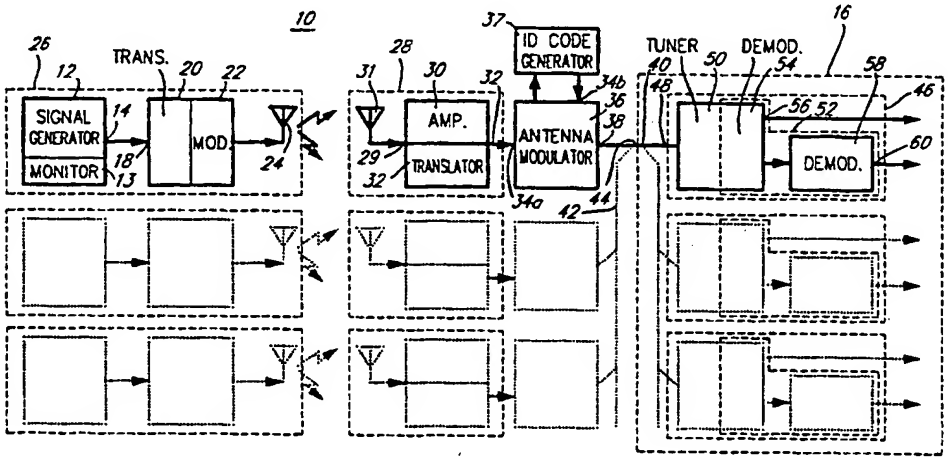

(57) Abstract

A transmitter locating system, and more specifically, a person locating system capable of providing a communication link available for data or speech transmission toward a central station is disclosed. The system comprises at least one modulation signal generator coupled to a transmitter for producing a first modulated carrier frequency signal. The system is further comprised of a plurality of receiving antennas and corresponding antenna modulators distributed in a plurality of predetermined areas. At least one of the receiving antennas receives the first modulated carrier frequency signal and produces a corresponding received carrier frequency signal. The antenna modulators further have respective antenna identification code generators for producing a second modulation signal comprising a code identifying a corresponding receiving antenna. At least one of the antenna modulators produces a respective composite modulated carrier frequency signal carrying the first and second modulation signals and corresponding to the activating transmitter. The transmitter modulator and the antenna modulators are adapted to apply mutually orthogonal modulations. At least one receiver at a central station receives and demodulates the composite modulated carrier frequency signal, whereby the activating transmitter can be located within the plurality of predetermined areas.

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TRANSMITTER LOCATING SYSTEM
Description

Technical Field

The present invention generally relates to a transmitter locating system, and more specifically, to a person locating system capable of providing a communication link for data or speech transmission toward a central station.

Background Art

Transmitter locating systems, or person locating systems have been used for many years to monitor at a central station movement of transmitters or persons in a building, mine drifts, or similar places comprised of predetermined areas. Such locating systems are generally capable of providing a communication link for data or speech transmission toward the central station. This is the case for bio-telemetry and patient locating systems which are used in hospitals or other health care centers to both monitor physiological signs, such as cardiac or respiratory functions, of ambulatory at-risk patients and locate these patients in the building.

Such prior art system is disclosed in U.S. Pat. No. 5,153,584, to Engira, and in U.S. Pat. No. 4,958,645, to Cadell et al., which systems comprise one or more stationary location markers which transmit location data to an electrocardiogram (ECG) portable monitor worn by ambulatory patients. Through the use of demodulating and modulating devices, the ECG monitor combines ECG data with received location data from the nearest location marker, and retransmits this combined data to a stationary receiver which may display ECG and location data. Such a system has important drawbacks. Each patient monitor must be provided with a complex transceiver unit comprising a demodulating device for extracting location code data from the received signal transmitted by the location marker, and a modulating device for combining ECG data and location data prior to transmission toward the stationary receiver. Incorporation of a demodulator in each patient monitor tends to

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significantly increase the cost of the complete locating system which may include a thousand of such patient monitors.

Other patient or person locating systems such as those disclosed in U.S. Pat. 4,598,275, to Ross, or U.S. Pat. 4,275,385, to White, propose the use of a portable monitor or transmitter worn by a patient or person, which transmit bio-telemetry data or person identification data to a proximate one of a plurality of antenna receivers connected in a network to a central station. Each antenna receiver is provided with a demodulating device for extracting bio-telemetry or person identification data from the received signal transmitted by a portable monitor or transmitter, and a modulating device for combining received data with antenna location data code, prior to transmission toward the central station. Although such systems require less complex portable transmitters, they still require incorporation of expensive demodulating devices in all antenna receivers.

Summary of Invention

It is therefore a feature of the present invention to provide cost effective transmitter locating system capable of being used as a person or patient locating system.

Another feature of the present invention is to provide a transmitter locating system capable of providing a communication link available for data or speech transmission toward a central station.

Another feature of the present invention is to provide a bio-telemetry and patient locating system capable of transmitting physiological signs monitored signals to a central station.

According to the above features, from a broad aspect, the present invention provides a transmitter locating system comprising at least one signal generating unit for producing a first modulation signal at an output thereof. For each generating unit, the system is provided with a corresponding transmitter connected to the output of the associated signal generating unit. Each transmitter has a transmitter modulator

for receiving an associated first modulation signal to produce a first modulated carrier frequency signal at a respective transmission frequency. Each transmitter is provided with a transmitter antenna for transmitting this first modulated carrier frequency signal. The system is further comprised of a plurality of receiving antennas and corresponding antenna modulators distributed in a plurality of predetermined areas. These antenna modulators have first inputs respectively connected to respective outputs provided on the receiving antennas. At least one of the receiving antennas receives the first modulated carrier frequency signal and produces at its respective output a corresponding received carrier frequency signal. The antenna modulators further have respective antenna identification code generators for producing a second modulation signal comprising a code identifying a corresponding receiving antenna. The antenna modulators further have second inputs for respectively receiving the second modulation signal, and respective modulator outputs. A least one of the antenna modulators receives the received carrier frequency signal respectively from at least one of the receiving antennas to produce at its respective antenna modulator output a respective composite modulated carrier frequency signal carrying the first and second modulation signals and corresponding to the activating transmitter. The transmitter modulator and the antenna modulators are adapted to apply mutually orthogonal modulations. The respective antenna modulator output is connected to a respective input of a common transmitting line. The system further comprises a central station connected to an output of the transmitting line, which station comprises at least one receiving unit corresponding to a respective one of the transmitters. Each receiving unit has an input connected to the transmitting line output. Each receiving unit further comprises a tuner and a receiver, which tuner being adapted to cause the receiver to receive the respective composite modulated carrier frequency signal corresponding to a respective activating transmitter and to the activated receiving antenna. The receiver is provided with a demodulator

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adapted to detect the respective composite modulated carrier frequency signal having highest mean amplitude value, to produce at a first output thereof a first demodulated output signal associated with the first modulation signal corresponding to the activating transmitter. The demodulator also produces at a second output thereof a second demodulated output signal associated with the second modulation signal and corresponding to the activated receiving antenna, whereby the activating transmitter can be located within the plurality of predetermined areas.

According to a further broad aspect of the invention, there is provided a transmitter locating system comprising at least one signal generating unit for producing a first modulation signal at an output thereof. For each generating unit, the system is provided with a corresponding transmitter connected to the output of the associated signal generating unit. Each transmitter has a transmitter modulator for receiving an associated first modulation signal to produce a first modulated carrier frequency signal at a transmission frequency. This first modulation signal comprises a transmitter identification code for identifying the activating transmitter. Each transmitter is provided with a transmitter antenna for periodically transmitting the first modulated carrier frequency signal according to a respective unique sequence for each transmitter. The system is further comprised of a plurality of receiving antennas and corresponding antenna modulators distributed in a plurality of predetermined areas. These antenna modulators have first inputs respectively connected to respective outputs provided on the receiving antennas. At least one of the receiving antennas receives the first modulated carrier frequency signal and produces at its respective output a corresponding received carrier frequency signal. The antenna modulators further have respective antenna identification code generators for producing a second modulation signal comprising a code identifying a corresponding receiving antenna. The antenna modulators further have second inputs for respectively receiving the second modulation signal,

and respective modulator outputs. At least one of the antenna modulators receives the received carrier frequency signal respectively from at least one of the receiving antennas to produce at its respective antenna modulator output a respective composite modulated carrier frequency signal carrying the first and second modulation signals and corresponding to the activating transmitter. The transmitter modulator and the antenna modulators are adapted to apply mutually orthogonal modulations. The respective antenna modulator output is connected to a respective input of a common transmitting line. The system further comprises a central station connected to an output of the transmitting line, which station comprises at least one receiving unit corresponding to a respective one of the transmitters. Each receiving unit has an input connected to the transmitting line output. Each receiving unit comprises a tuner and a receiver, which tuner being adapted to cause the receiver means to receive the respective composite modulated carrier frequency signal corresponding to a respective activating transmitter and to the activated receiving antenna. The receiver is provided with a demodulator adapted to detect the respective composite modulated carrier frequency signal having highest mean amplitude value, to produce at a first output thereof a first demodulated output signal associated with the first modulation signal corresponding to the activating transmitter, which first demodulated output signal comprises the transmitter identification code for identifying the activating transmitter. The demodulator also produces at a second output thereof a second demodulated output signal associated with the second modulation signal and corresponding to the activated receiving antenna, whereby the activating transmitter can be located within the plurality of predetermined areas.

Brief Description of the Drawings:

FIG. 1 is a general block diagram of the locating system according to a preferred embodiment of the present invention.

FIGS. 2A to 2F illustrate waveforms of different input and output signals related to a first operation principle of the preferred embodiment as shown in FIG. 1.

FIGS. 3A to 3G illustrate waveforms of different input and output signals related to an alternate operation principle of the preferred embodiment as shown in FIG. 1.

FIG. 4 is a general block diagram of the locating system according to the preferred embodiment of the present invention, for a particular case using FM and AM modulation techniques.

FIG. 5 is an electronic diagram of an example of an antenna unit circuit using FM/FSK and AM modulation techniques according to the preferred embodiment as shown in FIGS. 1 and 4.

FIG. 6 is an electronic diagram of an example of a receiving unit using FM/FSK and AM modulation techniques according to the preferred embodiment as shown in FIGS. 1 and 4.

Brief Description for Carrying out the Method

Referring to FIG. 1, there is schematically shown a locating system according to a first preferred embodiment of the present invention, generally designated at numeral 10. At least one signal generator 12 is provided for producing a first modulation signal at a respective output 14 thereof. There are generally provided as many signal generators as there are moving objects or persons to be located within predetermined areas covered by the system's range. This first modulation signal can be a data signal, such as a signal representative of a physiological sign or a speech signal, either in analog or digital form, which is to be remotely transmitted to a central station generally designated at numeral 16. A monitor 13 is used in applications which require the monitoring of a patient's physiological condition. For example, the monitor 13 would provide a signal representative of the heart rate or other condition to be transmitted to the central station. A respective first modulation signal is sent to a respective

input 18 of at least one transmitter 20 comprising a transmitter modulator 22 for producing at a transmitter antenna 24 a first modulated carrier frequency signal at a transmission frequency, which is chosen according to available channels of the selected radio frequency bandwidth. For locating more than one transmitter, two different approaches are proposed. A first approach consists in providing for each transmitter, a unique respective transmission frequency, thus enabling transmitter identification at the central station. A second approach consists in operating on a single common transmission frequency for all transmitters. However, an identification code is incorporated with the first modulation signal, enabling transmitter identification at the central station. Furthermore, so as to provide real time location of several transmitters operating at a common transmission frequency, each transmitter is adapted to transmit periodically its respective first modulated signal according to a respective unique sequence for each transmitter 20. It is pointed out that each signal generator 12 and its corresponding transmitter 20 are generally combined in the same portable transmitting unit designated at numeral 26 in FIG. 1.

The system 10 further comprises a plurality of receiving antenna units 28 having respective receiving antennas 31 adapted to receive a first modulated carrier frequency signal transmitted from anyone of transmitter antennas 24. However, only those receiving antennas 31 which are in the effective transmitting range of a given transmitter actually receive a corresponding first modulated carrier frequency signal coming from this transmitter. The antennas 31 are distributed within the predetermined areas (not shown) in a such manner that at least one of these antennas always receives a first modulated carrier frequency signal from a given transmitter present within the predetermined areas covered by the system's range. As is well known in the art, the receiving antennas 31 are connected to respective inputs 29 of optional antenna amplifiers 30 for received signal amplification purposes and optional frequency translators 32 incorporated in

respective antenna units 28. For a given activating transmitter producing a first modulated carrier frequency signal, at least one corresponding received carrier frequency signal is produced at each respective antenna unit output 32 and sent to first input 34a of antenna modulator 36. Each antenna modulator 36 has an antenna identification code generator means 37 for producing a second modulation signal comprising a code identifying a corresponding receiving antenna unit 28. The antenna modulators further have second inputs 34b for respectively receiving the second modulation signal. The antenna modulators 36 are provided with outputs 38. At least one antenna modulator 36 actually receiving a received carrier frequency signal, from at least one receiving antenna unit 28, produces a composite modulated carrier frequency signal, at antenna modulator output 38. The composite modulated carrier frequency signal carries first and second modulation signals corresponding to the activating transmitter unit 26. In the preferred embodiment of the invention, the transmitter modulators 22 and antenna modulators 36 are adapted in a such manner that they apply mutually orthogonal modulations. Such an orthogonal modulation can be obtained through any proper combination of either FM, FSK, PSK, QPSK, BPSK or M-PSK modulation techniques for transmitter modulation and with amplitude modulation technique used for antenna modulation. Alternatively, orthogonal modulation can also be obtained through any proper combination of amplitude modulation technique for transmitter modulation with either FM, FSK, PSK, QPSK, BPSK or M-PSK modulation techniques used for antenna modulation. Any other combination of transmitter and antenna modulators applying mutually orthogonal modulation techniques could be used for realizing the present invention. The respective composite modulated carrier frequency signals are then sent through respective inputs 40 of a common transmitting line 42 and output 44 thereof to the central station 16.

The central station 16 comprises at least one receiving unit 46 corresponding to a respective one of transmitting units 26. Each receiving unit 46 has an input 48

connected to the output 44 of the common transmitting line 42. Each receiving unit 46 comprises a tuner 50 and a receiver 52. The tuner 50 is adapted to cause the corresponding receiver 52 to receive a respective composite modulated carrier frequency signal corresponding to a respective one of transmitting unit 26 and to a respective one of receiving antenna units 28. Each receiver 52 is provided with a first demodulator 54 adapted to detect the respective composite modulated carrier frequency signal having highest mean amplitude value, to produce at an output 56 thereof a first demodulated output signal associated with a first modulation signal corresponding to a respective one of transmitting units 26. Each receiver 52 is further provided with a second demodulator 58 producing at a respective output 60 thereof a second demodulated output signal associated with a second modulation signal and corresponding to a respective one of receiving antennas. This second demodulated signal also corresponds to the composite modulated carrier frequency signal having highest mean amplitude value. With this latter signal, location of a respective one of transmitting units within said plurality of bounded spaces is provided.

Referring now to FIGS. 2A to 2F, the operation principle of a locating system according to the present invention which uses a combination of either FM, FSK, PSK, QPSK, BPSK or M-PSK modulation techniques for transmitter modulation with amplitude modulation technique for antenna modulation will be described. For the sake of clarity, FIGS. 2A to 2F illustrate a particular case wherein phase (FM) and AM modulations are applied respectively for transmitter modulation and antenna modulation. Other modulation techniques for transmitter modulation such as FSK, PSK, QPSK, BPSK or M-PSK digital modulation techniques can also be implemented according to the same operation principle with proper adaptation. Referring to FIG. 2A, a signal to be transmitted 62 is represented as a voltage with respect to time function. There is also shown a corresponding first phase (FM) modulated carrier frequency signal 64 as produced by the transmitter

modulator of a given transmitting unit and as transmitted by its transmitter antenna. It can be seen that the envelope of the modulated carrier frequency signal 64 is of a constant amplitude. Referring now to FIG. 2B, there is shown a corresponding carrier frequency signal 66 as received at a receiving antenna. It is pointed out that at the receiving point, the envelope 68 of the received carrier frequency signal 66 presents significant amplitude variation delta A which is due to hertzian wave transmission of the carrier frequency signal. Referring now to FIG. 2C, there is shown a composite modulated carrier frequency signal 70 carrying the first modulation signal through the phase (FM) modulation and a second modulation signal comprising a code identifying corresponding one of receiving antenna units through an amplitude modulation as shown with reference to numeral 72. It can be seen from FIG. 2C that amplitude variation delta A due to hertzian wave transmission of the carrier frequency signal is still present. Referring now to FIG. 2D, there is shown a first demodulated output signal 74 associated with the first modulation signal 62 as shown in FIG. 2A. The first demodulated output signal is produced at the output 56 of a first demodulator 54 comprised in the receiver 52 of a receiving unit 46, as shown in FIG. 1. Turning now to FIG. 2E, there is shown a second demodulated output signal 76 associated with the second modulation signal comprised in the composite first carrier frequency signal 70 as shown in FIG. 2C, which second modulation signal comprises the code identifying the corresponding one of receiving antenna units. It can be seen from FIG. 2E that the amplitude demodulation which is applied on the composite carrier frequency signal, results in the recovery of the second modulation signal. The amplitude variation delta A which is due to hertzian wave transmission of the carrier frequency signal is still superimposed on the second modulation signal. Turning now to FIG. 2F, there is finally shown a second demodulated output signal 78, wherein the amplitude variation delta A has been filtered out. Turning now to FIGS. 3A to 3G, an alternate way of operating the

locating system of the present invention will be described. In this embodiment, a combination of amplitude modulation techniques for transmitter modulation with either FM, FSK, PSK, QPSK, BPSK or M-PSK antenna modulation techniques is used. For the sake of clarity, FIGS. 3A to 3G illustrate a particular case wherein AM and phase (FM) modulations are applied respectively for transmitter modulation and antenna modulation. Other antenna modulation techniques such as FSK, PSK, QPSK, BPSK or M-PSK digital modulation techniques can also be implemented. Referring now to FIG. 3A, a signal to be transmitted 63 is represented as a voltage with respect to time function. Turning now to FIG. 3B, there is shown a corresponding first AM modulated carrier frequency signal 65 as produced by the transmitter modulator of a given transmitting unit and as transmitted by its transmitter antenna. It can be seen that the amplitude of the envelope 67 of the modulated carrier frequency signal 65 is essentially proportional to its corresponding signal to be transmitted 63. Referring now to FIG. 3C, there is shown a corresponding carrier frequency signal 69 as received at a receiving antenna. It should be pointed out that at the receiving point, the envelope 71 of the received carrier frequency signal 69 presents significant amplitude variation compared to the respective envelope 67 of the initially transmitted carrier frequency signal. This variation is due to hertzian wave transmission of the carrier frequency signal. Referring now to FIG. 3D, there is shown a composite modulated carrier frequency signal 73 carrying the first modulation signal through the AM modulation and a second modulation signal comprising a code identifying corresponding one of the receiving antenna units through a phase (FM) modulation. It can be seen from FIG. 3D that amplitude variation due to hertzian wave transmission of the carrier frequency signal is still present. Referring now to FIG. 3E, there is shown a first demodulated output signal 75 associated with the first modulation signal 63 as shown in FIG. 3A. The first demodulated output signal 75 is produced at the output 56 of first amplitude demodulator 54. The demodulator 54 is part

of receiver 52 of receiving unit 46, as shown in FIG. 1. It can be seen from FIG. 3E that amplitude variation due to hertzian wave transmission of the carrier frequency signal is still present in the first output demodulated signal 77. Turning now to FIG. 3F, there is shown the first demodulated output signal 77 after filtering out the amplitude variation due to hertzian wave transmission of the carrier frequency signal. Referring now to FIG. 3G, there is shown a second demodulated output signal 79 as produced by the phase (FM) demodulator. The signal 79 is associated with the second modulation signal comprised in the composite first carrier frequency signal 73 shown in FIG. 3D. Also, the second modulation signal comprises the code identifying the corresponding one of receiving antenna units.

Referring now to FIG. 4, there is shown a block diagram of the locating system according to another embodiment of the present invention. Elements appearing in FIG. 4 which were also used in Figure 1, will be identified using same numerals as used in FIG. 1. The signal generator 12 shown in Figure 4, is provided with a sub modulation signal generator 15 for producing at an output 17 thereof, a sub modulation signal. The signal generator 12 further comprises a sub carrier modulator 19 for receiving the sub modulation signal. In this embodiment, an FM sub modulator is used. The sub carrier modulator 19 receives the sub modulation signal at output 21 to produce a first modulation signal at a respective sub carrier frequency for each signal generator 12. In this particular case, the first modulation signal is an analog signal to be remotely transmitted to a central station generally designated at numeral 16. A respective first modulation signal is sent to a respective input 18 of at least one transmitter 20 comprising a transmitter modulator 22 for producing at a transmitter antenna 24 a first modulated carrier frequency signal at a transmission frequency, which is still chosen according to available channels of the selected radio frequency bandwidth. The two different approaches for locating more than one transmitter as earlier described with reference to FIG. 1 are

still applicable for the present case. Therefore, a unique transmission frequency for each transmitter or a single common transmission frequency for all transmitters 20, but incorporating in the first modulation signal, a transmitter identification code data, can be chosen. In the latter case, real time location of several transmitters 20 operating at a common transmission frequency can be carried out, provided each transmitter 20 is adapted to transmit periodically its respective first modulated signal according to a unique sequence. Here again, it should be pointed out that each signal generator 12 and its corresponding transmitter 20 are generally combined in the same portable transmitting unit shown at numeral 26 of FIG. 4.

As explained earlier, the system 10 further comprises a plurality of receiving antenna units 28 each having receiving antennas 31 adapted to receive a first modulated carrier frequency signal transmitted from anyone of transmitter antennas 24. As indicated before, only those receiving antennas 31 which are in the effective transmitting range of a given transmitter actually receive a corresponding first modulated carrier frequency signal. The antennas 31 are still distributed within the predetermined areas (not shown) in such a manner that at least one of these antennas always receives a signal from a given transmitter 20 present within the predetermined areas covered by the system's range.

As mentioned earlier, the receiving antennas 31 are connected to respective inputs 29 of optional antenna amplifiers 30 for received signal amplification purposes and optional frequency translators 32 incorporated in respective antenna units 28. As indicated earlier, for a given activating transmitter producing a first modulated carrier frequency signal, at least one corresponding received carrier frequency signal is produced at respective antenna units outputs 32 and sent to respective first inputs 34 of the antenna modulators 36. Here again, the antenna modulators 36 have respective antenna identification code generator means 37 for producing a second modulation signal comprising a code identifying a

corresponding receiving antenna unit 28.

The second modulating signal is a binary encoded message, which is repetitively transmitted and which is specific to each antenna modulator. In the present embodiment, the message is twelve (12) bits long, Manchester encoded, comprising a one (1) as start bit, eight (8) bits giving 256 antennae specific addresses in binary format, two (2) bits reserved for future use and a final one (1) as stop bit. The invention is not, however, limited to such an antenna identification format. The code generator means can consist of an erasable, non-volatile, electronic memory, wherein the content is repetitively read. Each antenna having a memory programmed with its specific message. The content of the memory is read through the use of a dedicated electronic logic circuit that generates the clock and address signals required to read the electronic memory. Similarly, the invention is not, however, limited to such generator means.

The antenna modulators further have second inputs 34b for respectively receiving the second modulation signal, and respective antenna modulator outputs 38. At least one antenna modulator 36 actually receiving a received carrier frequency signal respectively from at least one receiving antenna unit 28 produces at a respective antenna modulator output 38 a respective composite modulated carrier frequency signal carrying the first and second modulation signals corresponding to the activating transmitter unit 26. It should be pointed out that, in the preferred embodiment of the invention, the transmitter modulators 22 and antenna modulators 36 are adapted to apply mutually orthogonal modulations. In this particular case, an orthogonal modulation is obtained through combination of FM modulation technique for transmitter modulation with amplitude modulation technique used for antenna modulation. Alternatively, orthogonal modulation as required by the present invention can also be obtain in this particular case through a combination of amplitude modulation technique for transmitter modulation with FM modulation technique for antenna modulation. The respective composite modulated carrier frequency signals

are then sent through respective inputs 40 of a common transmitting line 42 and output 44 thereof to the central station 16. The central station 16 still comprises at least one receiving unit 46 corresponding to a respective one of transmitting units 26. Each receiving unit 46 has an input 48 connected to the output 44 of the common transmitting line 42. Each receiving unit 46 comprises a tuner 50 and a receiver 52. The tuner 50 is adapted to cause the corresponding receiver 52 to receive a respective composite modulated carrier frequency signal corresponding to a respective one of the transmitting units 26 and to a respective one of the receiving antenna units 28. Each receiver 52 is provided with a first demodulator 54 adapted to detect the respective composite modulated carrier frequency signal having highest mean amplitude value, to produce at an output 55 thereof a partially demodulated signal associated to a corresponding first modulation signal. In a particular case where FM modulation technique is used for transmitter modulation, the first demodulator is a FM demodulator. Each receiver 52 is further provided with a sub carrier demodulator 54, which is a FM demodulator in this particular case, having an input 57 connected to the first demodulator 54 for receiving the partially demodulated signal to produce at output 56 a first demodulated output signal corresponding to the sub modulation signal as produced by the respective activating one of the transmitting units 26. Each receiver 52 is further provided with a second demodulator 58, which is an amplitude demodulator in this particular case, producing at a respective output 60 thereof a second demodulated output signal associated with a second modulation signal and corresponding to a respective one of the receiving antennas 31. Here again, this second demodulated signal also corresponds to the composite modulated carrier frequency signal having highest mean amplitude value. With this latter signal, location of a respective one of transmitting units 26 within said plurality of predetermined areas is provided.

Turning now to FIG. 5, an electronic diagram of an example of an antenna unit circuit for use with FM or FSK modulation technique for transmitter modulator and AM modulation technique for antenna modulator is shown. In FIG. 5, there is shown a receiving antenna 80 having an output 82 coupled to an input 84 of an optional amplifier circuit 86, sending at an outpput 88 thereof an amplified first modulated carrier frequency signal at a respective transmission frequency, toward the input 90 of a receiving bandpass filter circuit 92. The bandwidth of the receiving bandpass filter 92 is chosen to comprise the respective transmission frequency corresponding to each transmitter. For example, in the particular embodiment of FIG. 5, a bandpass filter having a 6 MHz bandwidth centered at 177 MHz would be generally capable of receiving all transmitting channels required for a bio-telemetry monitoring system. A filtered first modulated carrier frequency signal is sent through an output 94 thereof toward an input 96 of a translator circuit 98, which lowered the respective transmission frequency of the first modulated carrier frequency signal to a respective first intermediate frequency to produce a received carrier frequency signal at an output 100 thereof. For example, in the particular example as shown in FIG. 5, the center frequency of 177 MHz could be translated to 44 MHz keeping the bandwidth at 6 MHz. A suitable voltage applied to tuning input 102 provided in the translator circuit 98 provides bandwidth selection to a desired centered intermediate frequency. The received carrier frequency signal is then sent to an input 102 of a translator output bandpass filter 104 having a bandwidth selected to comprise the first intermediate frequency. The filtered received carrier frequency signal is then sent to an input 106 of an antenna modulator 108 showing a control gain amplifier design in the example as shown in FIG. 5. The antenna modulator 108 has an antenna identification code generator means (not shown) for producing a second modulation signal comprising a code for identifying the receiving antenna 80. This second modulation signal is sent to a second input 110

provided on the antenna modulator 108. The latter is further provided with an output 112 through which a composite modulated carrier frequency signal carrying the first and second modulation signals and corresponding to the activating transmitter is sent toward a central station (not shown) via a common transmitting line 114.

Turning now to FIG. 6, there is shown an electronic diagram of an example of a receiving unit provided in the central station as proposed by the present invention. A receiving unit applies an FM or FSK demodulation technique for the transmitter demodulator and an AM demodulation technique for the antenna demodulator, for use in combination with the antenna unit as shown in FIG. 5. The receiving unit as generally designated at numeral 116 in FIG. 6 comprises a tuner circuit 118 coupled to a receiver circuit 120. The tuner circuit receives from a receiving unit input 122 coupled to the common transmitting line 114 the composite modulated carrier frequency signal corresponding to a respective one of the transmitters and to a respective one of the receiving antennas. The tuner circuit 118 comprises a pre-tuning bandpass filter 124 for pre-filtering the entering composite modulated carrier frequency signal. For example, a suitable pre-tuning bandpass filter could have a 1 MHz bandwidth for roughly selecting a desired transmitted channel with its adjacent transmitter channels. The pre-tuning bandpass filter 124 has an output 126 being connected to a mixer circuit 130 through a first input 128 thereof. The tuning circuit 118 further comprises an oscillator circuit 132 having a first output 134 connected to a second input 136 of the mixer circuit 130 for sending a translating frequency signal thereto. The oscillator circuit 132 further has a second output 138 being connected to an input 140 of a synthesizing circuit 142. The synthesizing circuit 142 is adapted to produce at an output 144 a translating frequency correction signal associated with the composite modulated carrier frequency signal corresponding to a respective one of the transmitters. The synthesizing circuit output 144 is connected to the oscillator circuit 132 through

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an input 146 thereof for sending thereto the translating frequency correction signal. This causes the oscillator circuit to produce a substantially stable translating frequency signal associated with the composite modulated carrier frequency signal. The mixer circuit produces at an output 148 thereof and at a second intermediate frequency the composite modulated carrier frequency signal. For example, a suitable second intermediate frequency could be 10.7 MHz. The tuning circuit further has a tuning translator bandpass filter 150 having a bandwidth centered at the second intermediate frequency and having an input 152 connected to the mixer circuit output 148 for rejecting adjacent composite modulated carrier frequency signals on adjacent transmitter channels. The composite modulated carrier frequency signal, produced at an output 154 corresponds to the respective activating one of the transmitters and to the respective one of the receiving antennas. The receiver 120 provided on receiving unit 116 comprises a demodulator circuit generally designated at numeral 156. The demodulator 156 comprises an intermediate frequency amplifier 158 having a main output 160 coupled in series with an input 162 of a limiter amplifier 164. The demodulator 156 further comprises a multiplier 166 and a frequency to phase converter circuit 168. The limiter amplifier 164 further has first and second outputs 170 and 170' producing respectively first and complementary phased second amplified signals corresponding to the respective composite modulated carrier frequency signal. The second output 170' is connected to a first input 172 provided on the multiplier 166. The first input 170 is connected to a second input 174 provided on the multiplier 166 and to an input 176 of the frequency to phase converter 168. A phase varying signal corresponding to the received carrier frequency signal, is sent to a third input 178 provided on the multiplier 166. The multiplier 166 finally produces at an output 180 thereof the first demodulated output signal, along with a corresponding complementary signal produced at an output 184 of a second multiplier 182 coupled to a complementary output 186 provided on the multiplier 166. The

frequency amplifier 158 and the limiter amplifier 164 have respective secondary outputs 188 and 190 for sending secondary amplified signals corresponding to the respective composite modulated carrier frequency signal to a received signal strength indicator 192. The signal strength indicator 192 is located in series with a lo-pass filter 194 through a pair of inputs 196 and 196' provided on the signal strength indicator 192. The lo-pass filter 194 produces at an output 198 thereof a carrier amplitude level signal comprising a hertzian wave transmission signal component superposed on the second modulation signal. The demodulator further comprises a filter circuit (not shown) for filtering out this hertzian wave transmission signal component to produce the second demodulated output signal. This latter filter circuit can be realized using a currently available digital signal processor.

It is within the ambit of the present invention to cover any obvious modifications in the proposed system, and any locating applications thereof, provided such modifications and applications fall within the scope of the appended claims.

CLAIMS

1. A locating system adapted to locate one of a number of portable transmitting units from amongst a plurality of receiving antenna units located in predetermined areas, wherein each portable transmitting unit can transmit an information carrying signal to a central station via one of said receiving antenna unit, comprising:

a signal generator, at said portable transmitting unit for generating a first modulation signal to be transmitted to said central station;

a transmitter modulator for generating a modulated carrier frequency signal from said modulation signal;

a transmitter for transmitting said modulated carrier frequency signal at a predetermined frequency associated with said portable transmitting unit;

a receiving antenna unit for receiving said first modulated carrier frequency signal and producing a received carrier frequency signal;

an antenna modulator associated with said receiving antenna unit, said antenna modulator having an identification code generator for generating a second modulation signal comprising a code for identifying which one of said plurality of receiving antenna units received the first modulated carrier frequency signal, said antenna modulator being adapted to generate a composite modulated carrier frequency signal comprising said first and second modulation signals, such that said composite modulated carrier frequency signal is orthogonal to said first modulated carrier frequency signal;

said central station, comprising:

a receiving unit associated with each one of said portable transmitting units, said receiving unit comprising tuner means and receiver means, said tuner means being adapted to cause said receiver means to receive said composite modulated carrier frequency signal, said receiver means being provided with demodulator means adapted to detect said composite modulated carrier frequency signal having highest

mean amplitude value, to produce a first demodulated output signal associated with said first modulation signal, and a second demodulated output signal associated with said second modulation signal, thereby determining the location of said portable transmitting units from amongst the plurality of receiving antenna units located in said predetermined areas.

2. A locating system as claimed in claim 1, wherein said receiving antenna units further comprise bandpass filter means having a bandwidth selected to pass said transmitting frequency corresponding to each of said portable transmitting units.

3. A locating system as claimed in claim 1, wherein said receiving antenna units further comprise translator means for lowering said transmitting frequency of said first modulated carrier frequency signal to a first intermediate frequency to thereby produce said received carrier frequency signal.

4. A locating system as claimed in claim 3, wherein said translator means comprises a translator output bandpass filter having a bandwidth selected to pass said first intermediate frequency.

5. A locating system as claimed in claim 4, wherein said tuner means comprise pre-tuning bandpass filter means for pre-filtering said composite modulated carrier frequency signal, said pre-tuning bandpass filter means having an output being connected to a mixer means through a first input thereof, said tuning means further comprising oscillator means having a first output connected to a second input of said mixer means for sending a translating frequency signal thereto, said oscillator means further having a second output connected to an input of a synthesizing means adapted to produce at an output thereof a translating frequency correction signal associated with said composite modulated carrier frequency signal corresponding to said transmitter, said synthesizing means output being connected to said oscillator means through an input thereof for

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sending said translating frequency correction signal thereto to cause said oscillator to produce a substantially stable translating frequency signal associated with said composite modulated carrier frequency signal, said mixer means producing at an output thereof a signal at a second intermediate frequency, said tuning means further having a tuning translator bandpass filter having a bandwidth centered at said second intermediate frequency and having an input connected to said mixer means output for rejecting adjacent composite modulated carrier frequency signals thereby producing at an output thereof said composite modulated carrier frequency signal.

6. A locating system as claimed in claim 5, wherein said transmitter modulator is a FM or PSK modulator, said first modulation signal is adapted either to FM or PSK modulation, said demodulator means comprising an intermediate frequency amplifier having a main output connected in series with an input of a limiter amplifier, said demodulator means further comprising multiplier means and frequency to phase converter means, said limiter amplifier further having first and second outputs producing respectively first and complementary phased second amplified signals corresponding to said composite modulated carrier frequency signal, said second output being connected to a first input provided on said multiplier means, said first input being connected to a second input provided on said multiplier means and to an input of said frequency to phase converter means for sending to a third input provided on said multiplier means a phase varying signal corresponding to said received carrier frequency signal, said multiplier means producing at an output thereof said first demodulated output signal.

7. A locating system as claimed in claim 6, wherein said antenna modulators are amplitude modulators and said second modulation signal is amplitude modulated, said frequency amplifier and said limiter amplifier have respective secondary outputs for sending secondary amplified signals corresponding

to said composite modulated carrier frequency signal to a received signal strength indicator means in series with a lo-pass filter means through a pair of inputs provided on said strength indicator means, said lo-pass filter means producing at an output thereof a carrier amplitude level signal comprising a hertzian wave transmission signal component superimposed on said second modulation signal, said demodulator means further comprising means for filtering out said hertzian wave transmission signal component to produce said second demodulated output signal.

8. A locating system as claimed in claim 1, wherein said transmitter modulator comprises one of an FM, FSK, PSK, QPSK BPSK and M-PSK modulator, said first modulation signal is modulated according to a selected one of said modulator and said antenna modulators are amplitude modulators, said second modulation signal is amplitude modulated.

9. A locating system as claimed in claim 1, wherein said transmitter modulator is an amplitude modulator, said first modulation signal is amplitude modulated and each antenna modulator comprises one of an FM, FSK, PSK, QPSK, BPSK and M-PSK modulator, said second modulation signal is modulated according to a selected one of said modulator.

10. A locating system as claimed in claim 1, wherein said system is used as a person locating system, said signal generator and said transmitter are respectively carried by at least one person to be located within said predetermined areas.

11. A locating system as claimed in claim 1, wherein said system is used as a bio-telemetry and patient locating system, said signal generator and said transmitter are respectively carried by at least one patient to be located within said predetermined areas, said signal generator comprises monitor means for monitoring a physiological signal from a patient

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causing said signal generator to produce said first modulation signal.

12. A locating system adapted to locate one of a number of portable transmitting units from amongst of plurality of receiving antenna units located in predetermined areas, wherein each portable transmitting unit can transmit an information carrying signal to a central station via one of said receiving antenna units, comprising:

a signal generator, at said portable transmitting unit, having:

i) a submodulation signal generator for generating a submodulation signal; and

ii) a subcarrier modulator for generating, from said submodulation signal, a first modulation signal at a subcarrier frequency;

a transmitter having a transmitter modulator for producing a first modulated carrier frequency signal from said first modulation signal, said transmitter transmitting said first modulated carrier frequency signal at a predetermined frequency associated with said portable transmitting unit;

a receiving antenna unit for receiving said first modulated carrier frequency signal and producing a received carrier frequency signal;

an antenna modulator associated with said receiving antenna unit, said antenna modulator having an identification code generator for generating a second modulation signal comprising a code for identifying which one of said plurality of receiving antenna units received the first modulated carrier frequency signal, said antenna modulator being adapted to generate a composite modulated carrier frequency signal comprising said first and second modulation signals, such that said composite modulated carrier frequency signal is orthogonal to said first modulated carrier frequency signal;

said central station, comprising:

a receiving unit associated with each one of said portable transmitting units, said receiving unit comprising

tuner means and receiver means, said tuner means being adapted to cause said receiver means to receive said composite modulated carrier frequency signal, said receiver means being provided with demodulator means adapted to detect said composite modulated carrier frequency signal having highest mean amplitude value, to produce a first demodulated output signal associated with said submodulation signal of said one of a number of portable transmitting units, and a second demodulated output signal associated with said second modulation signal, thereby determining the location of said one portable transmitting unit from amongst the plurality of receiving antenna units located in said predetermined areas.

13. A transmitter locating system as claimed in claim 12, wherein said receiving antenna means further comprise receiving bandpass filter means having a bandwidth selected to pass said respective transmission frequency corresponding to each of said transmitting units.

14. A transmitter locating system as claimed in claim 12, wherein said receiving antenna means further comprise translator means for lowering said transmission frequency of said first modulated carrier frequency signal to a respective first intermediate frequency to thereby produce said received carrier frequency signal.

15. A transmitter locating system as claimed in claim 14, wherein said translator means comprises a translator output bandpass filter having a bandwidth selected to pass said first intermediate frequency.

16. A transmitter locating system as claimed in claim 15, wherein said tuner means comprise pre-tuning bandpass filter means for pre-filtering said respective composite modulated carrier frequency signal corresponding to one of said portable transmitting units and to one of said receiving antenna units, said pre-tuning bandpass filter having an output being

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connected to a mixer means through a first input thereof, said tuning means further comprising oscillator means having a first output connected to a second input of said mixer means for sending a translating frequency signal thereto, said oscillator means further having a second output connected to an input of a synthesizing means adapted to produce at an output thereof a translating frequency correction signal associated with said composite modulated carrier frequency signal corresponding to one of said transmitting units, said synthesizing means output being connected to said oscillator means through an input thereof for sending said translating frequency correction signal thereto to cause said oscillator to produce a substantially stable translating frequency signal associated with said composite modulated carrier frequency signal corresponding to one of said portable transmitting units, said mixer means producing at an output thereof a signal at a second intermediate frequency corresponding to one of said portable transmitting units and to one of said receiving antenna units, said tuning means further having a tuning translator bandpass filter having a bandwidth centered at said second intermediate frequency and having an input connected to said mixer means output for rejecting adjacent composite modulated carrier frequency signals thereby producing at an output thereof said composite modulated carrier frequency signal.

17. A transmitter locating system as claimed in claim 16, wherein said transmitter modulator is a FM modulator, said first modulation signal is adapted to FM modulation, said demodulator means comprising an intermediate frequency amplifier having a main output connected in series with an input of a limiter amplifier, said demodulator means further comprise multiplier means and frequency to phase converter means, said limiter amplifier further having first and second outputs producing respectively first and complementary phased second amplified signals corresponding to said respective composite modulated carrier frequency signal, said second output being connected to a first input provided on said

multiplier means, said first input being connected to a second input provided on said multiplier means and to an input of said frequency to phase converter means for sending to a third input provided on said multiplier means a phase varying signal corresponding to said received carrier frequency signal, said multiplier means producing at an output thereof a partially demodulated signal associated to said first modulation signal, said demodulator means further comprising a sub carrier demodulator having an input connected to said multiplier means output for receiving said partially demodulated signal to produce said first demodulated output signal at said output of said demodulator means.

18. A transmitter locating system as claimed in claim 17, wherein said antenna modulators are amplitude modulators, said second modulation signal is adapted to an amplitude modulation, said frequency amplifier and said limiter amplifier have respective secondary outputs for sending secondary amplified signals corresponding to said respective composite modulated carrier frequency signal to a received signal strength indicator means in series with a lo-pass filter means through a pair of inputs provided on said signal strength indicator means, said lo-pass filter means producing at an output thereof a carrier amplitude level signal comprising a hertzian wave transmission signal component superposed on said second modulation signal, said demodulator means further comprising means for filtering out said hertzian wave transmission signal component to produce said second demodulated output signal.

19. A transmitter locating system as claimed in claim 12, wherein said transmitter modulator is an FM modulator, said first modulation signal FM modulated and said antenna modulators are amplitude modulators, said second modulation signal is amplitude modulated.

20. A transmitter locating system as claimed in claim 12, wherein said transmitter modulator is an amplitude modulator, said first modulation signal is amplitude modulated and each antenna modulator comprises one of an FM, FSK, PSK, QPSK BPSK and M-PSK modulator, said second modulation signal is modulated according to a selected one of said modulator.

21. A transmitter locating system as claimed in claim 12, wherein said system is used as a person locating system, said signal generator and said transmitter are adapted to be carried by at least one person to be located within said predetermined areas.

22. A transmitter locating system as claimed in claim 12, wherein said system is used as a bio-telemetry and patient locating system, said signal generator and said transmitter are adapted to be carried by at least one patient to be located within said predetermined areas, said submodulation signal to be transmitted is a physiological signal from said patient, said submodulation signal generator is a physiological monitor.

23. A locating system adapted to locate one of a number of portable transmitting units from amongst a plurality of receiving antenna units located in predetermined areas, wherein each portable transmitting unit can transmit an information carrying signal to a central station via one of said receiving antenna unit, comprising:

a transmitter having a transmitter modulator for generating a modulated carrier frequency signal from first modulation signal originating from signal source, said first modulation signal comprising a transmitter identification code for identifying said one of a number of portable transmitting units, said transmitter periodically transmitting said first modulated carrier frequency signal according to a unique sequence;

a receiving antenna unit for receiving said first modulated carrier frequency signal and producing a received

carrier frequency signal;

an antenna modulator associated with said receiving antenna unit, said antenna modulator having an identification code generator for generating a second modulation signal comprising a code for identifying which one of said plurality of receiving antenna units received the first modulated carrier frequency signal, said antenna modulator being adapted to generate a composite modulated carrier frequency signal comprising said first and second modulation signals, such that said composite modulated carrier frequency signal is orthogonal to said first modulated carrier frequency signal;

said central station, comprising:

a receiving unit associated with each one of said portable transmitting units, said receiving unit comprising tuner means and receiver means, said tuner means being adapted to cause said receiver means to receive said composite modulated carrier frequency signal, said receiver means being provided with demodulator means adapted to detect said composite modulated carrier frequency signal having highest mean amplitude value, to produce a first demodulated output signal associated with said first modulation signal and comprising said transmitter identification code for identifying the corresponding one of said portable transmitting units, and a second demodulated output signal associated with said second modulation signal, thereby determining the location of said portable transmitting units from amongst the plurality of receiving antenna units located in said predetermined areas.

24. A transmitter locating system as claimed in claim 23, wherein said receiving antenna unit further comprises receiving bandpass filter means having a bandwidth selected to pass said transmission frequency corresponding to each of said transmitting units.

25. A transmitter locating system as claimed in claim 23, wherein said receiving antenna unit further comprises translator means for lowering said transmission frequency of

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said first modulated carrier frequency signal to a first intermediate frequency to produce said received carrier frequency signal.

26. A transmitter locating system as claimed in claim 25, wherein said translator means comprises a translator output bandpass filter having a bandwidth selected to pass said first intermediate frequency.

27. A transmitter locating system as claimed in claim 26, wherein said tuner means comprise pre-tuning bandpass filter means for pre-filtering said respective composite modulated carrier frequency signal corresponding to one of said portable transmitting units and to one of said receiving antenna units, said pre-tuning bandpass filter having an output being connected to mixer means through a first input thereof, said tuning means further comprising oscillator means having a first output connected to a second input of said mixer means for sending a translating frequency signal thereto, said oscillator means further having a second output connected to an input of a synthesizing means adapted to produce at an output thereof a translating frequency correction signal associated with said composite modulated carrier frequency signal corresponding to one of said portable transmitting units, said synthesizing means output being connected to said oscillator means through an input thereof for sending said translating frequency correction signal thereto to cause said oscillator to produce a substantially stable translating frequency signal associated with said composite modulated carrier frequency signal corresponding to said one of said portable transmitting units, said mixer means producing at an output thereof a signal at a second intermediate frequency corresponding to said one of said portable transmitting units and to one of said receiving antenna units, said tuning means further having a tuning translator bandpass filter having a bandwidth centered at said second intermediate frequency and having an input connected to said mixer means output for producing at an output thereof said

composite modulated carrier frequency signal corresponding to one of said portable transmitting units and to one of said receiving antenna units.

28. A transmitter locating system as claimed in claim 27, wherein said transmitter modulator is a FM or FSK modulator, said first modulation signal is adapted to either FM or FSK modulation, said demodulator means comprising an intermediate frequency amplifier having a main output connected in series with an input of a limiter amplifier, said demodulator means further comprise multiplier means and frequency to phase converter means, said limiter amplifier further having first and second outputs producing respectively first and complementary phased second amplified signals corresponding to said composite modulated carrier frequency signal, said second output being connected to a first input provided on said multiplier means, said first input being connected to a second input provided on said multiplier means and to an input of said frequency to phase converter means for sending to a third input provided on said multiplier means a phase varying signal corresponding to said received carrier frequency signal, said multiplier means producing at an output thereof said first demodulated output signal.

29. A transmitter locating system as claimed in claim 28, wherein said antenna modulators are amplitude modulators, said second modulation signal is an amplitude modulation signal, said frequency amplifier and said limiter amplifier have respective secondary outputs for sending secondary amplified signals corresponding to said composite modulated carrier frequency signal to a received signal strength indicator means in series with a lo-pass filter means through a pair of inputs provided on said signal strength indicator means, said lo-pass filter means producing at an output thereof a carrier amplitude level signal comprising a hertzian wave transmission signal component superposed on said second modulation signal, said demodulator means further comprising means for filtering out

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said hertzian wave transmission signal component to produce said second demodulated output signal.

30. A transmitter locating system as claimed in claim 23 wherein said transmitter modulator comprises one of a FM, FSK, PSK, QPSK, BPSK, M-PSK modulator, said first modulation signal is modulated according to a selected one of said transmitter modulator and said antenna modulators are amplitude modulators, said second modulation signal is amplitude modulated.

31. A transmitter locating system as claimed in claim 23, wherein said transmitter modulation signal is an amplitude modulator, said first modulation signal is amplitude modulated and each antenna modulator comprises one of an FM, FSK, PSK, QPSK, BPSK and M-PSK modulator, said second modulation signal is modulated according to a selected one of said antenna modulator.

32. A transmitter locating system as claimed in claim 31, wherein said system is used as a person locating system, said signal generator and said transmitter are adapted to be carried by at least one person to be located within said predetermined areas.

33. A locating system adapted to locate one of a number of portable transmitting units from amongst a plurality of receiving antenna units located in predetermined areas, wherein each portable transmitting unit can transmit an information carrying signal to a central station via one of said receiving antenna unit, comprising:

a signal generator, at said portable transmitting unit, having:

i) a submodulation signal generator for generating a submodulation signal; and

ii) a subcarrier modulator for generating, from said submodulation signal, a first modulation signal at a subcarrier frequency;

a transmitter having a transmitter modulator for generating a modulated carrier frequency signal from first modulation signal originating from signal source, said first modulation signal comprising a transmitter identification code for identifying said one of a number of portable transmitting units, said transmitter periodically transmitting said first modulated carrier frequency signal according to a unique sequence;

a receiving antenna unit for receiving said first modulated carrier frequency signal and producing a received carrier frequency signal;

an antenna modulator associated with said receiving antenna unit, said antenna modulator having an identification code generator for generating a second modulation signal comprising a code for identifying which one of said plurality of receiving antenna units received the first modulated carrier frequency signal, said antenna modulator being adapted to generate a composite modulated carrier frequency signal comprising said first and second modulation signals, such that said composite modulated carrier frequency signal is orthogonal to said first modulated carrier frequency signal;

said central station, comprising:

a receiving unit associated with each one of said portable transmitting units, said receiving unit comprising tuner means and receiver means, said tuner means being adapted to cause said receiver means to receive said composite modulated carrier frequency signal, said receiver means being provided with demodulator means adapted to detect said composite modulated carrier frequency signal having highest mean amplitude value, to produce a first demodulated output signal associated with said submodulation signal and comprising said transmitter identification code for identifying the corresponding one of said portable transmitting units, and a second demodulated output signal associated with said second modulation signal, thereby determining the location of said portable transmitting units from amongst the plurality of receiving antenna units located in said predetermined areas.

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34. A transmitter locating system as claimed in claim 33, wherein said receiving antenna unit further comprises receiving bandpass filter means having a bandwidth selected to pass said transmission frequency corresponding to each of said transmitting units.

35. A transmitter locating system as claimed in claim 33, wherein said receiving antenna unit further comprises translator means for lowering said transmission frequency of said first modulated carrier frequency signal to a first intermediate frequency to produce said received carrier frequency signal.

36. A transmitter locating system as claimed in claim 35, wherein said translator means comprises a translator output bandpass filter having a bandwidth selected to pass said first intermediate frequency.

37. A transmitter locating system as claimed in claim 36, wherein said tuner means comprise pre-tuning bandpass filter means for pre-filtering said composite modulated carrier frequency signal corresponding to one of said portable transmitting unit and to one of said receiving antenna units, said pre-tuning bandpass filter having an output being connected to mixer means through a first input thereof, said tuning means further comprising oscillator means having a first output connected to a second input of said mixer means for sending a translating frequency signal thereto, said oscillator means further having a second output connected to an input of a synthesizing means adapted to produce at an output thereof a translating frequency correction signal associated with said composite modulated carrier frequency signal corresponding to said one of said portable transmitting units, said synthesizing means output being connected to said oscillator means through an input thereof for sending said translating frequency correction signal thereto to cause said oscillator to produce a

substantially stable translating frequency signal associated with said composite modulated carrier frequency signal corresponding to one of said portable transmitting units, said mixer means producing at an output thereof a signal at a second intermediate frequency corresponding to one of said portable transmitting units and to one of said receiving antenna units, said tuning means further having a tuning translator bandpass filter having a bandwidth centered at said second intermediate frequency and having an input connected to said mixer means output for rejecting adjacent composite modulated carrier frequency signals thereby producing at an output thereof said composite modulated carrier frequency signal corresponding to one of said portable transmitting units and to one of said receiving antenna units.

38. A transmitter locating system as claimed in claim 37, wherein said transmitter modulator is a FM modulator, said first modulation signal is FM modulated, said demodulator means comprising an intermediate frequency amplifier having a main output connected in series with an input of a limiter amplifier, said demodulator means further comprise multiplier means and frequency to phase converter means, said limiter amplifier further having first and second outputs producing respectively first and complementary phased second amplified signals corresponding to said respective composite modulated carrier frequency signal, said second output being connected to a first input provided on said multiplier means, said first input being connected to a second input provided on said multiplier means and to an input of said frequency to phase converter means for sending to a third input provided on said multiplier means a phase varying signal corresponding to said received carrier frequency signal, said multiplier means producing at an output thereof a partially demodulated signal associated to said first modulation signal, said demodulator means further comprising a sub carrier demodulator having an input connected to said multiplier means output for receiving said partially demodulated signal to produce said first

demodulated output signal at said output of said demodulator means.

39. A transmitter locating system as claimed in claim 38, wherein said antenna modulators are amplitude modulators, said second modulation signal is amplitude modulated, said frequency amplifier and said limiter amplifier have respective secondary outputs for sending secondary amplified signals corresponding to said respective composite modulated carrier frequency signal to a received signal strength indicator means in series with a lo-pass filter means through a pair of inputs provided on said signal strength indicator means, said lo-pass filter means producing at an output thereof a carrier amplitude level signal comprising a hertzian wave transmission signal component superposed on said second modulation signal, said demodulator means further comprising means for filtering out said hertzian wave transmission signal component to produce said second demodulated output signal.

40. A transmitter locating system as claimed in claim 33, wherein said transmitter modulator is a FM modulator, said first modulation signal is FM modulated and each antenna modulator is an amplitude modulator, said second modulation signal is amplitude modulated.

41. A transmitter locating system as claimed in claim 33, wherein said transmitter modulator is an amplitude modulator, said first modulation signal is amplitude modulated. and each antenna modulator comprises one of an FM, FSK, PSK, QPSK, BPSK and M-PSK modulator, said second modulation signal is modulated according to a selected one of said antenna modulator.

42. A transmitter locating system as claimed in claim 33, wherein said system is used as a person locating system, said signal generator and said transmitting unit are adapted to be carried by at least one person to be located within said predetermined areas.

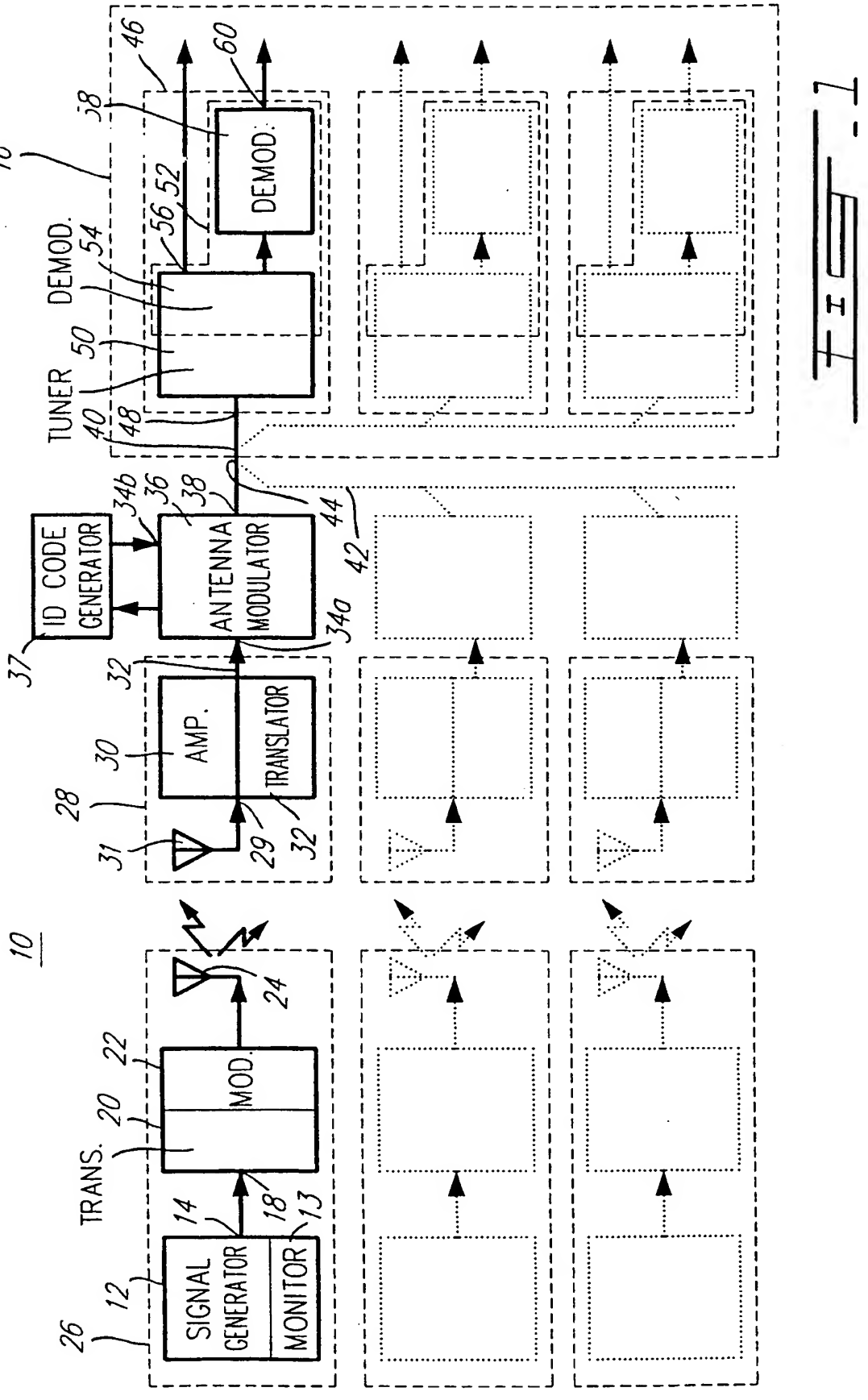
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FIG. 1

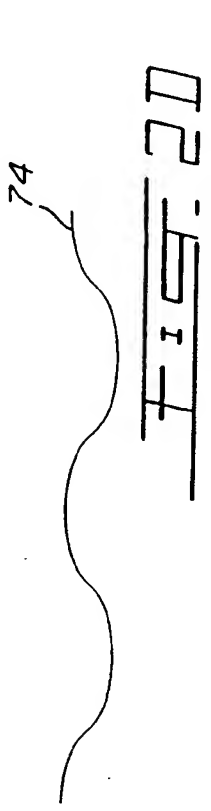

FIG. 2D

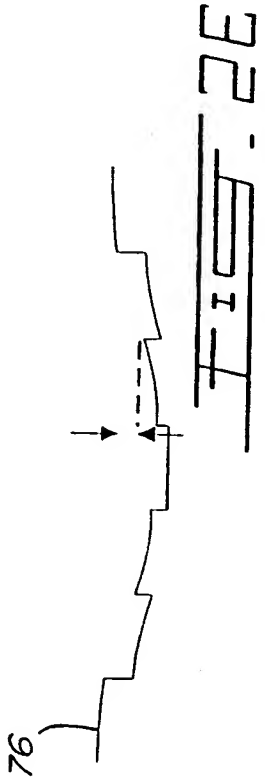

FIG. 2E

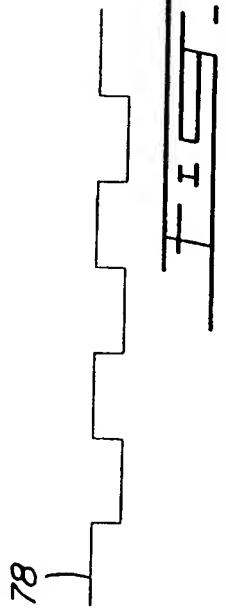

FIG. 2F

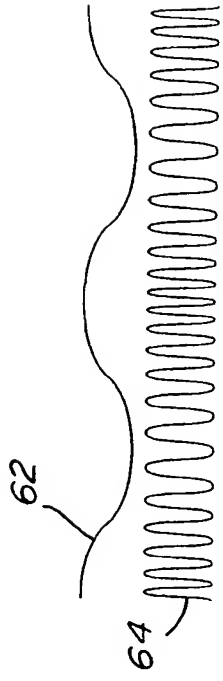

FIG. 2A

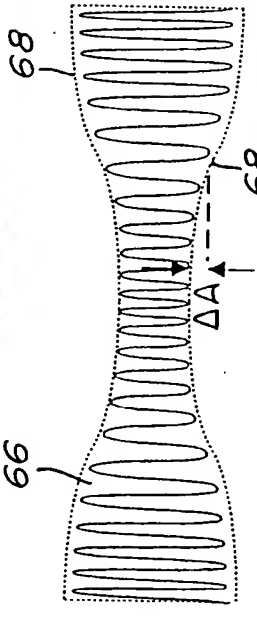

FIG. 2B

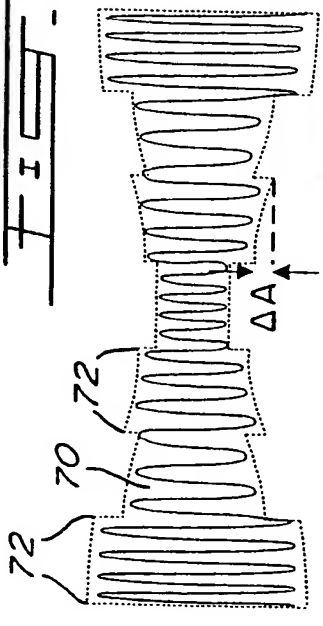

FIG. 2C

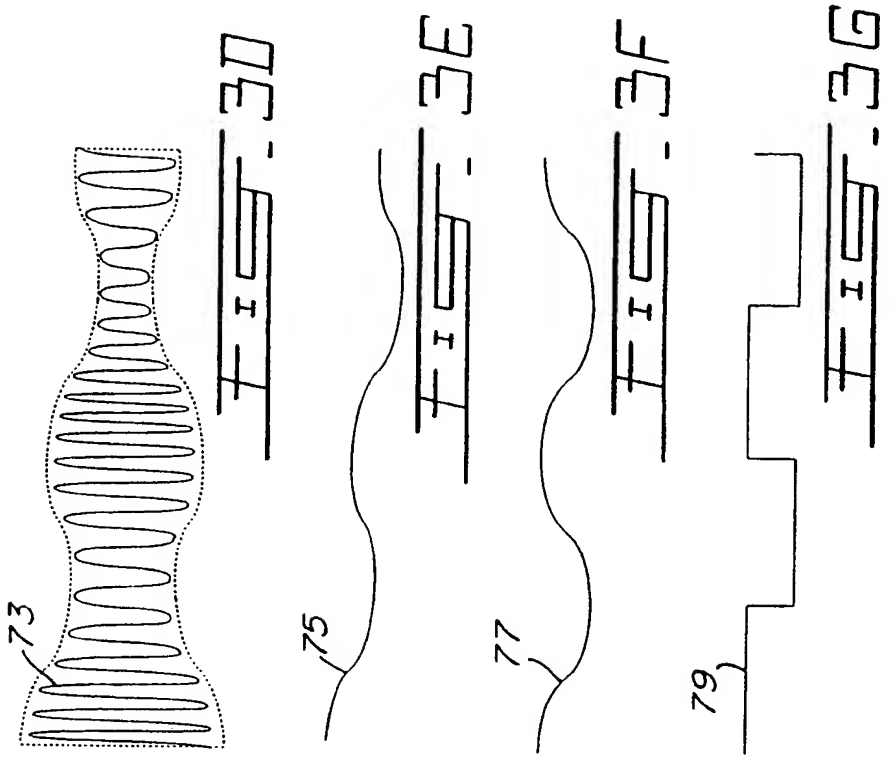

FIG - 3D

FIG - 3E

FIG - 3F

FIG - 3G

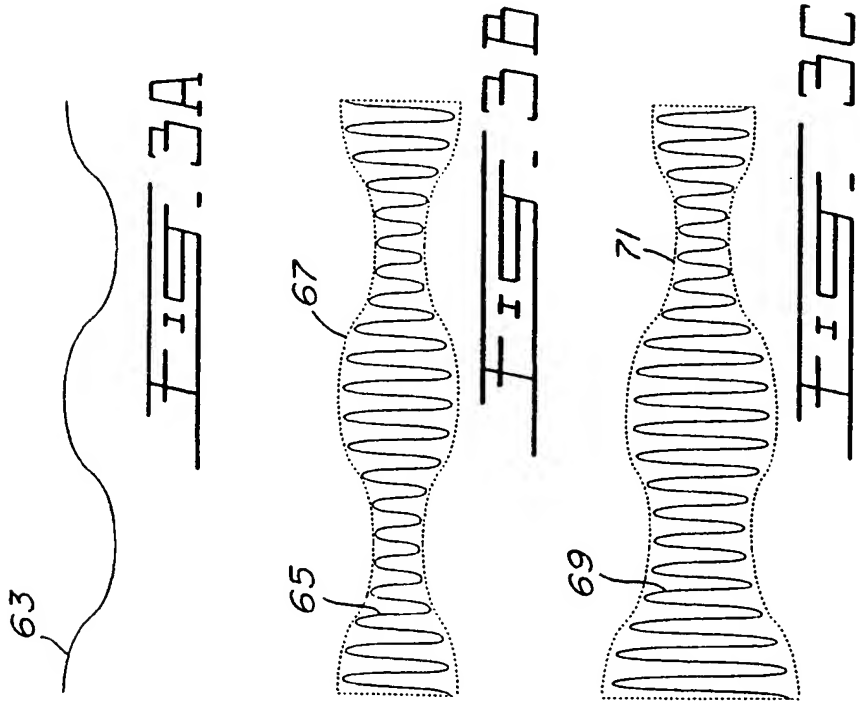

FIG - 3A

FIG - 3B

FIG - 3C

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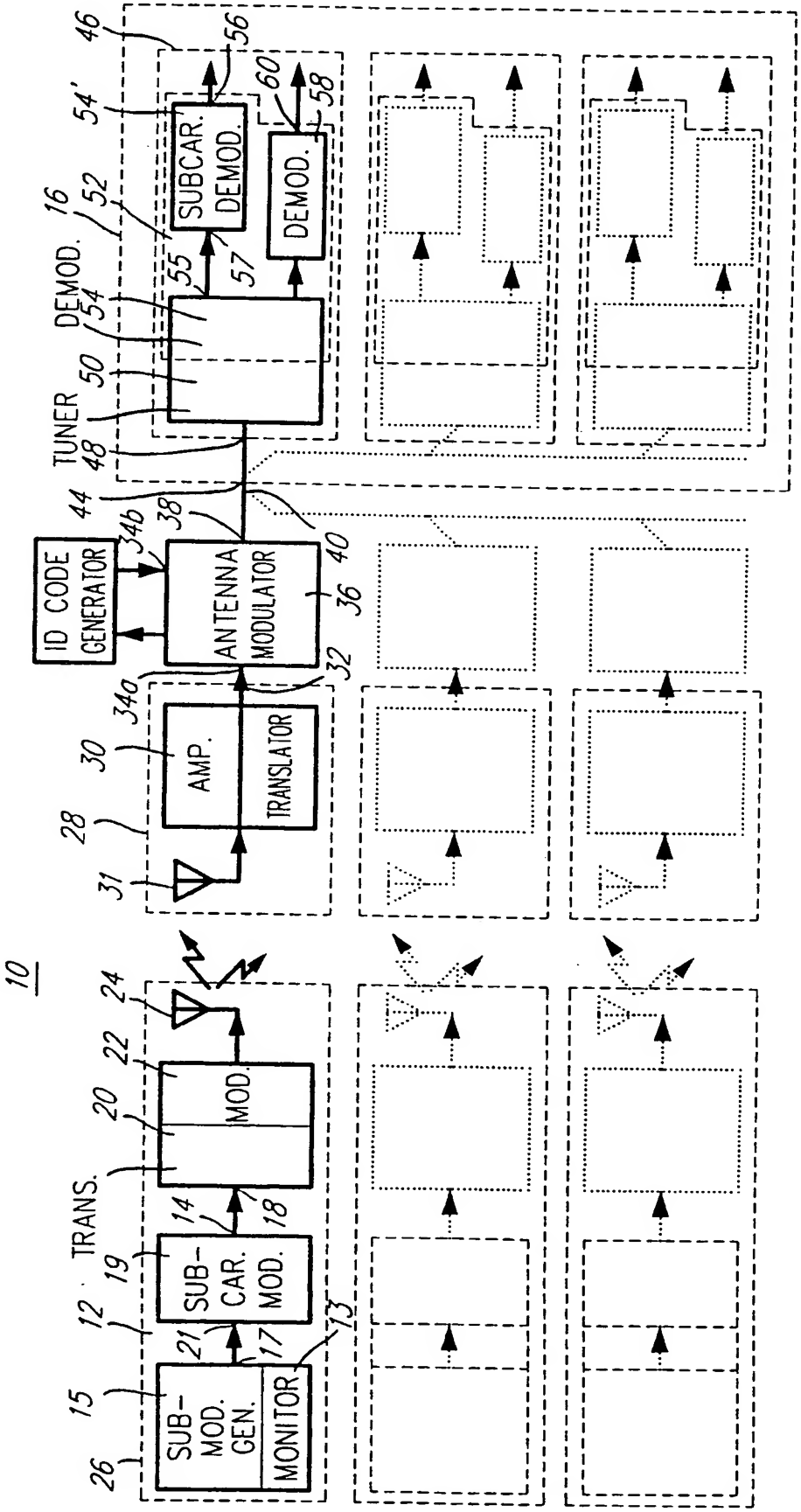
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TRANS.
SUB-MOD. GEN.
MONITOR
SUB-CAR. MOD.
MOD.
AMP.
TRANSLATOR
ANTENNA
ID CODE GENERATOR
MODULATOR
TUNER
DEMOD.
SUBCAR. DEMOD.
DEMOD.

FIG-4

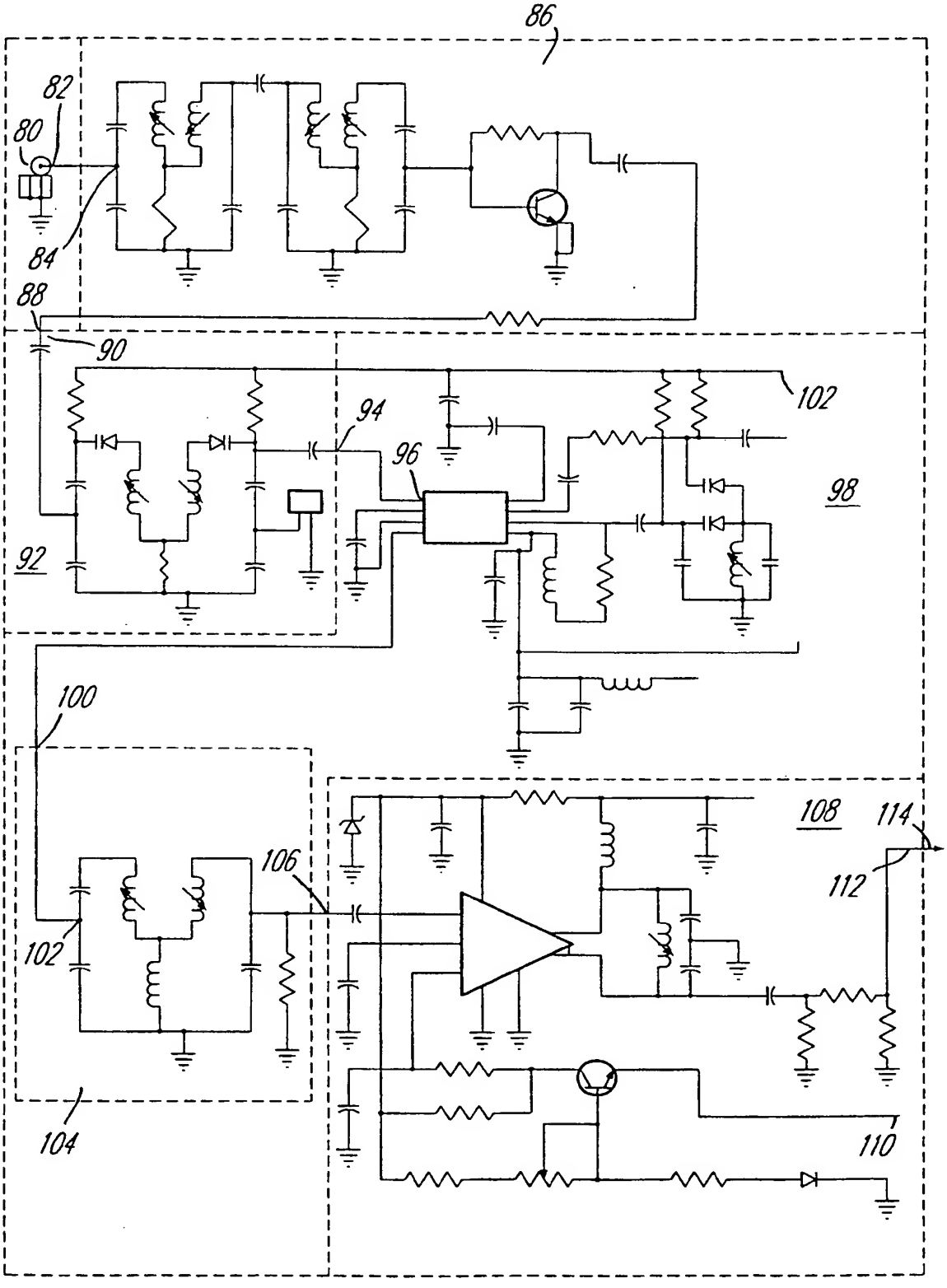

FIG. 5

BNSDOCID: <WO 9530970A1 >

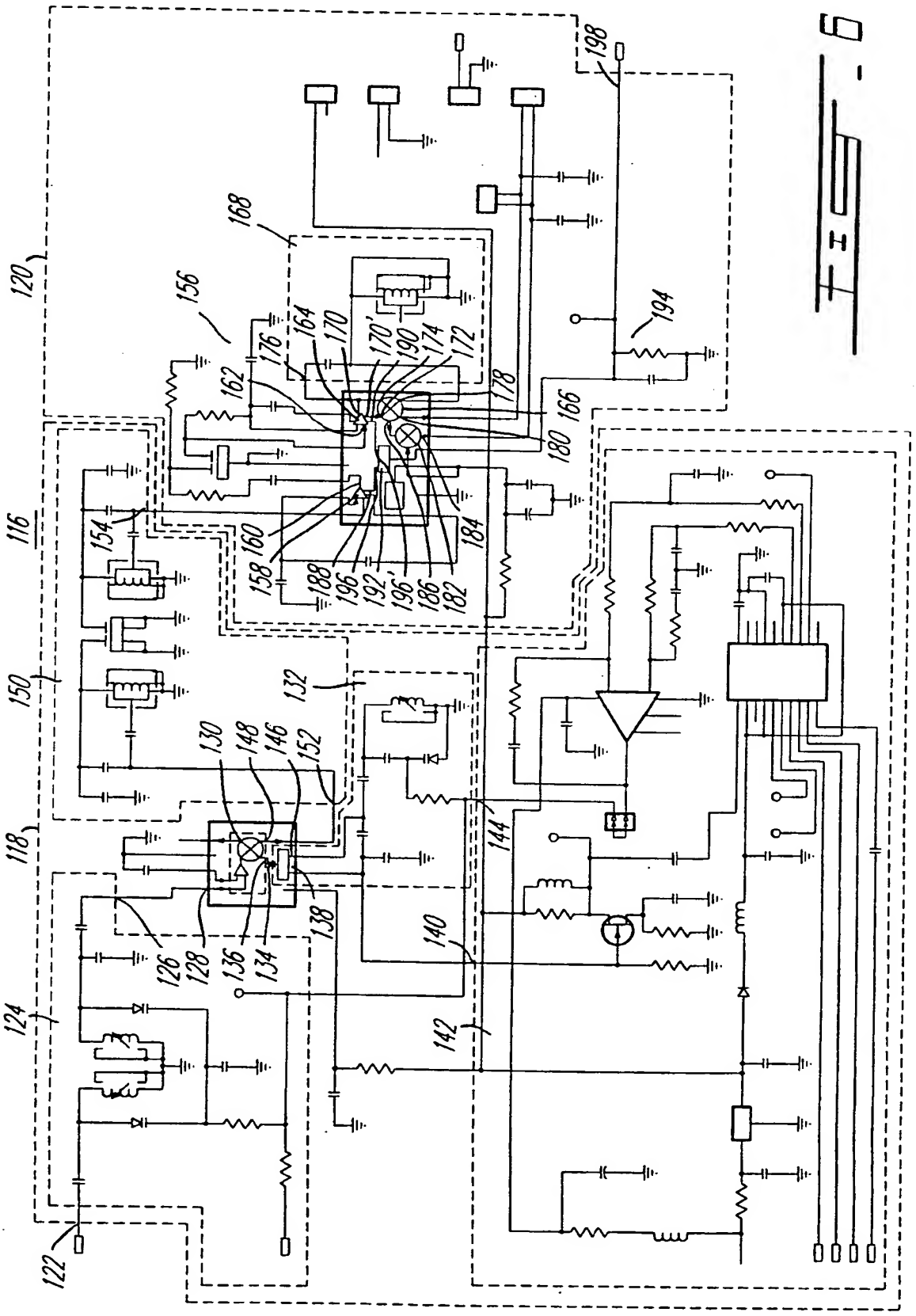
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FIG. 5

INTERNATIONAL SEARCH REPORT

Inter. nal Application No
PCT/CA 95/00224

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 G07C9/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G07C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP,A,0 575 753 (MOTOROLA INC) 29 December 1993 see page 8, line 9 - line 14; claim 1; figures 1,7	1-42
A	EP,A,0 402 129 (DEVOY RALPH P) 12 December 1990 see page 11, line 26 - line 48; claim 1; figures 1,11	1-42
A	WO,A,93 18476 (OLIVETTI RESEARCH LIMITED ;DIGITAL EQUIPMENT CORP (US)) 16 September 1993 see claim 1; figure 5	1-42

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 August 1995	01.09.95

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+ 31-70) 340-2040, Tx. 31 651 epo nl, Fax (+ 31-70) 340-3016	Kirsten, K

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INTERNATIONAL SEARCH REPORT

Interna l Application No
PCT/CA 95/00224

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,5 153 584 (ENGIRA RAM M) 6 October 1992 cited in the application see claim 1; figures 2,3	1-42
A	US,A,4 958 645 (CADELL THEODORE E ET AL) 25 September 1990 cited in the application see claim 1; figures 1,3	1-42

INTERNATIONAL SEARCH REPORT

Information on patent family members

Interna l Application No
PCT/CA 95/00224

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
EP-A-0575753	29-12-93	AU-B-	3698993	23-12-93
		JP-A-	6124375	06-05-94
		NZ-A-	247865	26-07-95
EP-A-0402129	12-12-90	NONE		
WO-A-9318476	16-09-93	CA-A-	2131726	16-09-93
		FI-A-	944111	02-11-94
		GB-A,B	2265038	15-09-93
		JP-T-	7504545	18-05-95
US-A-5153584	06-10-92	NONE		
US-A-4958645	25-09-90	NONE		

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